

# CRADA facts

DEPARTMENT OF ENERGY  
OFFICE OF FOSSIL ENERGY

COMBUSTION  
PROJECT

## LOW-BTU COMBUSTION STUDIES FACILITY

### Capabilities

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Sources for low-energy fuel include coal gasification, bio- and landfill-gasification, landfill gas capture, thermal-chemical recuperation, partial oxidation, and unreacted fuel-cell anode gas. In many cases, efficiency and pollution prevention require the complete oxidation of the low-energy fuel. FETC is currently studying combustor designs for such low-energy fuel applications. The Low-Btu Combustion Studies Facility has been constructed to produce the required syngas for specific applications and to develop, study, and optimize various atmospheric-pressure combustor designs. The facility is available for use by industrial and university partners through CRADAs or other cooperative arrangements. Protection of all intellectual property is possible through CRADA-supported work.

The facility is currently configured to support fuel-cell applications; specifically, molten-carbonate fuel-cell anode-gas uses. However, since the facility is flexible enough to support a range in syngas production, it can also be used for coal, biomass, or other applications. For the current fuel-cell studies, a pure oxygen gas stream is used to oxidize natural gas. This stream is mixed with a stream of pure carbon dioxide, to produce the necessary fuel-cell anode syngas (fuel energy densities of 30 to 40 Btu/ft<sup>3</sup>) at rates of up to 1,000 scf/h. By proportioning the various flows, a range of elemental carbon-to-hydrogen ratios and residual fuel-energy densities can be studied. Heat exchange coils can be used to tailor the syngas to temperatures of less than 1,500 °F. Mixtures of air and oxygen can be used to produce streams with the desired nitrogen content for other applications. In addition, fuel staging can be used to produce streams with super-equilibrium methane or higher hydrocarbon concentrations.

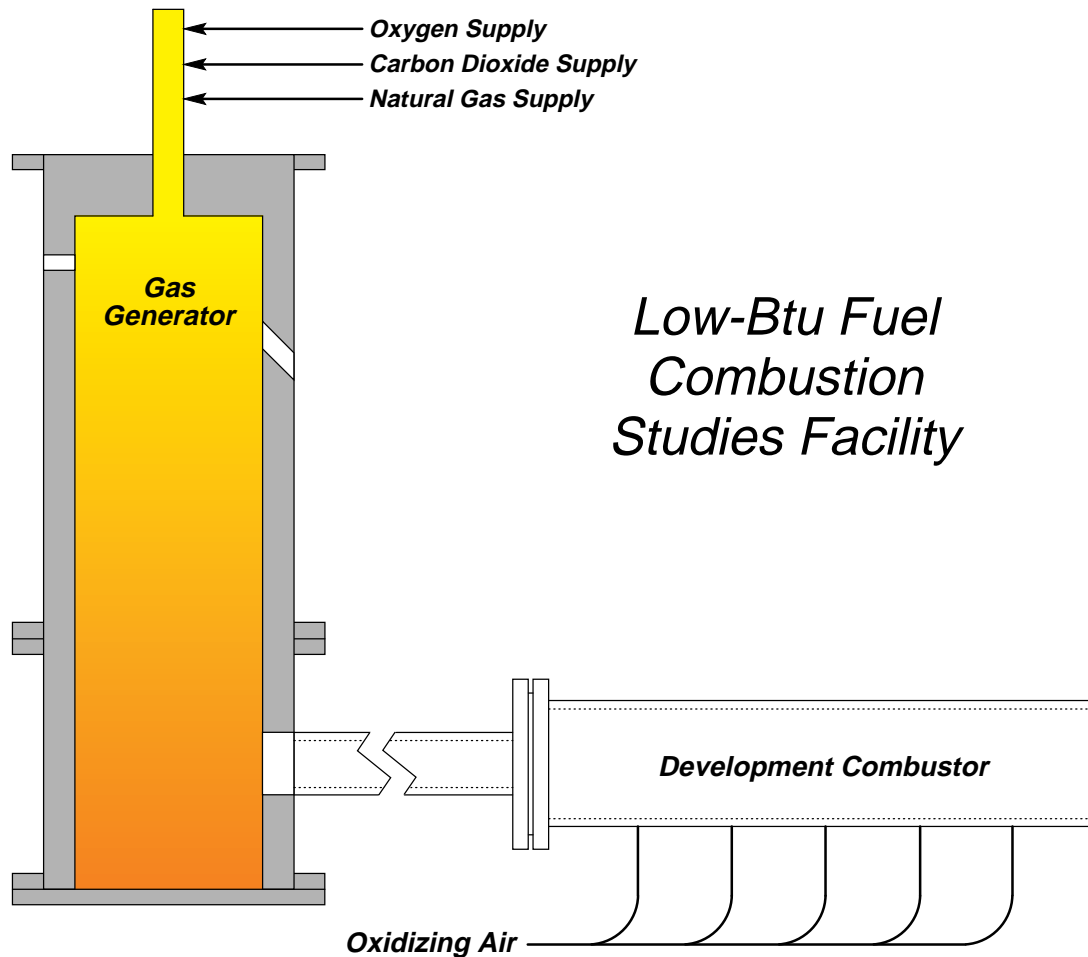
**Diagnostic and Analysis Capabilities.** This facility has access to many of the diagnostic tools typically employed in modern laboratory-based research and development work:

- Laser-based diagnostics for flow measurement.
- On-line stack-gas analyzers for pollutant emissions.
- High-speed temperature and pressure measurement tools.
- High-speed data acquisition for combustor dynamics measurement.
- Standard video and high-speed imaging.

## LOW-BTU COMBUSTION STUDIES FACILITY

### Opportunities

Fuel cell activities will be completed in the near future. Follow-up studies, including hybrid cycles (fuel cell + gas turbine), are anticipated. The facility is also available for integrated combined-cycle (IGCC) applications to investigate combustor design requirements for coal gas or other less understood fuels. Experimental and modeling support is available. Industrial and university partnerships are possible through CRADAs or other cooperative means.



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